

# Introduction

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As we learn more about the oceans, atmosphere, biosphere, chemical cycles, and other global systems, we also learn more about humanity's growing influence over them. We begin to get a clearer idea of our possible futures, a mixture of opportunity and hazards, marked by the inexorable, if heretofore unintentional, increase in human domination — and therefore responsibility — over global processes and the life with which we coexist. At the same time, we are creatures of our history and the realities of human interactions and institutions. While a certain optimism derives from the end of the Cold War and the concomitant increase in human economic and political freedom, history warns us to be cautious about our ability to live peacefully and prosperously.

For centuries, the nation-state has been the predominant organizational structure defining global human activity. While nation-transcending organizations and relationships are increasingly influential, the supremacy of nation-states remains the case (Brown Weiss). Virtually all peoples profoundly value the integrity of their nation, their national security. In turn, this security is heavily dependent on international political stability and global economic access, especially for developed countries. Such security derives from civil international relations and openness, but experience has consistently demonstrated that it also must rely on military strength as well, that society at any level does not remain orderly and peaceful without a disciplinary force. Currently, this principle in practice means that much responsibility for world order, directly or indirectly, devolves to the United States.

At the same time the absolute scale and global integration of human activities, and the realization of the importance of environmental factors in achieving and sustaining a desirable quality of life, have added complexity to this picture. Such developments require of us more subtle and more complex approaches to the maintenance of our own security (Allenby: Dimensions). To claim that all issues which impact our well-being are at heart issues of national security is, of course, not true and not useful. To claim that national security responsibilities in the more complex post-Cold War era are satisfied by military capability alone is also inadequate to the effective pursuit of our future national interest.

The essays in this collection deal with some of the most important environmental issues which might affect national security, and with some of the contextual mechanisms — national policy and international law and agreements — which are being used to create a structure for their management. These essays do not knit into a coherent or comprehensive study — the field of study is not yet at that point — but do highlight some of the most important and complex problems and current responses to them. The articles also focus on issues and concerns from the perspective of the United States; this

reflects both the composition of the workshop and the leading role of U.S. policymakers in developing this area (Dabelko and Simmons; Haspel; David). In the following few pages, we will introduce the reader to these topics.

## **Environmental issues**

Environmental security is a term that is currently being used to encompass the intersection of national security and environmental issues. Clearly, on the one hand, the complex forcing functions that drive international relations and even international and intranational conflict have environmental elements. While the ability of environmental stress to increase the probability of conflict is generally considered to be the essence of “environmental security,” it is the rare situation where “environmental” factors are the primary source of conflict (disputes over petroleum reserves are notable exceptions). Still, understanding high tension environmental factors concentrated in one locale might allow harmful confrontations to be anticipated and defused, and might enable the harm generated in ongoing violent situations to be minimized. This set of environmental issues is predominantly regional (Kennedy).

On the other hand, there are environmental situations that threaten all nations. In many cases, these perturbations, such as global climate changes and stratospheric ozone depletion, can cause great harm indiscriminately or even very locally, but do not threaten to cause conflict. This set of environmental issues is global and is generally identifiable with potential long-term economic and ecological instabilities.

In addition, there is currently an assignment of the term “environmental security” to environmentally responsible military operations, and the extension of these activities to alliance making through the sharing of good environmental practices with other nations’ military establishments. This is a desirable and important confidence building activity, but it tends to be quite situation dependent. Consequently, this volume will concentrate on the general and specific aspects of *regional* and *global* environmental issues, and their impact on the U.S. national security.

## **U.S. national security**

Focusing first on the United States, it is useful to distinguish conceptual views of national security before bringing in the complexities of real situations. On the one hand, U.S. national security is identified with military superiority, the ability to win a conflict without any doubt, thereby both having the military resources when fighting is necessary and the dominance that deters opponents in the first place. This interpretation of national security responsibility, in addition to fighting war, includes international police actions, arms control, nonproliferation of weapons of mass destruction, and suppression of terrorism. Nuclear materials present other unique environmental and security issues (Schafer, et. al.).

At the other extreme, the broadest interpretation of national security includes all factors affecting the well-being of the citizens and economy of the United States, now and in the future. Such an interpretation includes, for examples, economic security and sustainable development issues.

In fact, most conflict situations in which the United States is currently engaged

around the world involve both traditional issues of ethnic hostility, territory and resource control, and a complex array of contextual issues. And, the array of responses to these situations includes diplomacy, treaty negotiation, and nongovernmental actions, as well as military force. In real situations U.S. leaders are called upon to assess and balance a broad range of values in defining our national security, and to use an array of methods to respond.

## **International context**

With the end of the Cold War, many regional instabilities have been unleashed, driven primarily by ethnic and cultural rivalries and underdeveloped social structures, and also by competition for limited resources and the collapse of national economic structures. While these situations are profoundly sad and often highly lethal, they do not threaten the United States directly unless they are of significant concern to powerful neighbors. Thus, local conflicts in Africa, South America, even Central Europe and Central America are often of less concern than those in the Middle East and around China and Japan. In the longer term, U.S. concerns are likely to center on the stability of those areas of the world where very rapid economic development will create an unpredictable mix of enormous economic power coupled with international competition and antagonism.

As Weiss points out, the nature of international interaction and law is changing profoundly from centuries past when the internal workings of interacting states were of little concern and nongovernment organizations (NGOs) had no standing or influence. Today, news and information of all types are accessible to and from all parts of the globe across all borders, and NGOs influence the day-to-day workings of business, government, and society, creating a new global fabric that is supranational. Optimistically, these mechanisms may uncover and diffuse potentially harmful circumstances before they reach conflict. Unfortunately, especially in periods of governmental transition, local unrest and conflict can be exacerbated by nongovernmental forces.

## **Global environmental issues**

The human population is increasing, and human use of resources is increasing per capita. Without major changes in culture and technology, the impact of humans on the Earth will continue its nonlinear increase.

Global environmental parameters are changing (Corell) and to some extent these changes are anthropogenic. Glaciers are retreating; the sea level is rising; precipitation patterns are shifting; plant and animal habitats are diminishing; previously localized diseases are spreading (Murphy); and the consensus is that the global temperature is increasing and that weather patterns are changing. These changes are occurring gradually, but nonlinear and discontinuous consequences are both possible and evidenced in paleologic data. Indeed, the accelerating effect of humanity on the global environment guarantees some dramatic changes, even if they are unpredictable and unforeseen. Developing the scientific and sociological infrastructures to understand and manage these perturbations will be extremely important and difficult.

Understanding global atmospheric mechanisms is at least conceptually eased by

the fact that they are integrative — that is, that they combine many separate and remote human actions into single forcing functions. The response of the system is thus largely independent of where, for example, the greenhouse gases or CFCs are released. Models for atmospheric chemistry and physics and interactions with the land and oceans are crossing the threshold of data integration, accuracy, and resolution that will provide credible global and eventually regional predictions (Eisenberger). And comprehensive, timely data are becoming available (Harriss; David). Our ability to predict the consequences of human actions will reinforce our responsibility for those consequences and the necessity to discipline ourselves on a scale that appears impossible at this time. We seem to be making progress in limiting our damage to the ozone layer, but is it possible to control the release of CO<sub>2</sub> into the atmosphere (Schipper)? And in the future might intimidation be used to enforce constraints on CO<sub>2</sub> production, thus making even global warming a risk factor for human conflict?

As our impact on the biosphere increases, we invade the habitats of other life forms with at least two adverse effects. We decrease Earth's biodiversity, thus increasing biovulnerability and losing the unpriced, but valuable services of ecosystems, such as wetlands' high ecological productivity and flood control. And we increase the release and diffusion of pathogens, bacteria, and viruses (Murphy). The diffusion of pathogens into new, and vulnerable, human and other biological communities would also be increased by global warming.

## **Regional environmental issues**

Access to oil, gas, coal, water, and other resources is essential for industry and agriculture. Huge resource concentrations, such as those of the Middle East, and disputed ownership, such as the oil and gas in the South China Sea shelf, will increase the potential for conflict as these resources increase in value, as occurred recently in the Persian Gulf War. As the Pacific Rim tigers grow out of the third world, additional stresses will occur (Hayes, et. al.). Direct impacts of energy production, such as the exploitation of coal and hydroelectric energy resources, have in contrast generally caused very local, intranational problems, displacing inhabitants and marring landscapes for the benefit of distant customers.

The development of river basin systems is another source of regional conflict (Gleick). In the case of Turkey's development of the Euphrates River for hydroelectricity and irrigation, downstream countries will get less of this river's water and energy and considerable tension is likely. Huge hydroelectric projects in both China (Three Rivers Gorge) and Canada (Quebec) have high environmental and human impact, and their scale suggests that the full consequences are not foreseeable. Water is a key element of the Middle East peace agreements between Israel and its neighbors.

The need for agricultural resources is both a regional and global problem (Kane). In general, industrial, agricultural, urban, and natural-habitat systems compete for water and fertile land within every regional ecology. And where these resources overlap the boundaries of evolving societies, particularly in Africa, international relations are particularly dynamic.

Industrialization of production, including agriculture, leads to pollution, acidification, eutrophication, and occasionally to desertification, effects which are not confined

to the offending industrial region. Tension between the United States and Canada, between Japan and China, and within Europe over acid rain, for example, illustrate one common, difficult to manage perturbation. Even when such effects are confined to the source nation, they can cause transitional quality-of-life stress, as in China (Smil), or severe debilitation, as in Russia (Feshbach), as well as significant environmental equity problems.

Flooding, droughts, famine, hurricanes and typhoons, tornadoes, and earthquakes are all regional risk factors. When occurrences of these disasters are repeated or prolonged, or when very sharp economic gradients occur because of resources inequities or concentrations, very large-scale migrations can occur, as is currently happening in Africa and China, and worldwide between wealth-disparate areas.

## **Coupling of the global and the regional**

Global conditions couple to local in a variety of ways, for example, through major ocean currents and current cycles like El Niño; through wind, storm, and precipitation patterns; through exposure to solar radiation because of variations in the atmospheric composition and cloud cover; through the timing, duration, and intensity of local seasonal cycles; and through changes in the general conditions for the breeding and transfer of infection.

El Niño, for example, which clearly depends for its drive on global thermodynamics, is the cause of the precipitation patterns in South America, probably also in the west of North America, and is thought to be coupled to the generation of typhoons in the west Pacific. Global temperature changes will affect El Niño and the strength and temperature of other ocean currents and might even disrupt metastabilities causing major changes in ocean current patterns and local weather conditions (Corell).

The total precipitation in the northeastern United States is increasing steadily. This trend is statistically significant and the weather changes are probably permanent.

Flooding is occurring this year at the 500-year-flood level in the Ohio River and Red River basins, after several years of extraordinary flooding in California and in the Mississippi and Missouri River basins. During early 1997, more tornadoes occurred in Arkansas in one day than are normally experienced in a year. These events may be statistical anomalies, but are clearly in excess of historical patterns. The flood effects are exacerbated by wetland destruction and flood plain development, which, while they are not changed climate conditions, are quasi-permanent changes in the regional vulnerability to existing conditions.

While the ozone hole in the south latitudes is concentrated over the South Pole, periodic reduced ozone concentrations occur in the northern hemisphere over Europe, Russia, and the United States, concentrating the potential for increased skin cancer in these locations. Thus, the ozone-depletion by CFCs generated worldwide will preferentially impact these regions.

Finally, small increases in temperature are expected to increase the germination of infectious diseases making them more available to vectors which themselves may be increased by warming conditions. When this is coupled with the impingement of expanding populations into previously isolated and remote areas which all have their own fungi, bacteria, and viruses, and with the proliferation of megacities where infec-

tions could propagate quickly, the threat of disease will be increased by changing global conditions, but will concentrate in regions of dense population.

Through such mechanisms, global changes which might seem remote can focus their impact locally and lethally. These problems are especially difficult to address, however, because the forcing activities (e.g., CFC and greenhouse gas emissions) are not concentrated in the affected regions and the concomitant afflictions may not be felt until future generations. The motivation to discipline human activities is lacking because the offenders are not located in the time and place of the offended.

## **Environmental threats to U.S. national interests**

All of the threats mentioned here and discussed in more detail later in this volume, be they regional or global, immediate or long term, will have the potential to influence U.S. national security and well-being. It is clearly in the best interest of the United States that the entire Earth be healthy, economically active, and managed rationally and responsibly. This is not only in the economic and ecological self interest of the United States, but coincident with our national values.

Thus, the scope of environmental issues relevant to the U.S. national interests contains at least two subsets: those that directly, immediately, and substantially impact U.S. security interests, and a much broader set that is more subtle and more diffuse, requiring attention, but not immediately affecting security (Allenby: Definition). Whereas the danger of immediate threats might be conflict, thus urging responses based on short-term conflict avoidance, the response to the broader set of issues will require cooperation based on credible science and a persuaded society. In many ways the less urgent environmental problems could prove to be the most difficult to deal with and the most threatening in the long run (Schipper).

## **Governmental responses to environmental threats**

Environmental threats require large-scale cooperative responses, brought about either by a broad societal commitment or by national and international enforcement. Of course, the best situation occurs when people collectively and accurately perceive the environmental implications of their actions, and act in the common (environmental) interest. Unfortunately, this happy situation is rare because most often the benefits of such actions do not fall to those who would bear the costs.

The role of NGOs in these diffuse situations is of increasing importance and in many cases has superseded the formal roles of governments, particularly when the environment is at issue (Weiss). But, the roles of governments in establishing policies, enacting and enforcing intra- and international laws, and executing programs remain the primary mechanisms for modifying and controlling human actions. As the holistic nature of global human interactions emerges as the key to sustainable human institutions, security of the environment is an increasingly important element informing and driving government actions (Dabelko and Simmons). "Meeting the Challenge of Global Threats" comprises a major portion of the U.S. National Science and Technology Council's recently published *National Security Science and Technology Strategic Plan*. Relevant portions of this and other key documents are provided in the last section of this book.

The Department of Defense has set *preventive defense* as doctrine for the formation of its strategies, tactics, and operations (Perry). Defined as *winning without fighting*, this doctrine requires in part a thorough knowledge of the environmental factors which might cause conflict and methods for dealing with these threats. In addition, the Defense Department has established an Assistant Secretary for Environmental Security (Goodman), whose role is both to ensure that operations are environmentally appropriate and that environmental security is a basis for relations and alliances between the U.S. military and the military institutions of allies and friends.

When he was the Secretary of State, Warren Christopher stated in several speeches that environmental factors should be formative in U.S. foreign policy and foreign aid programs, and he established a responsibility for environmental issues within his department. Quoting from his speech (Christopher) at Stanford University on April 9, 1996,

... our Administration has recognized from the beginning that our ability to advance our global interests is inextricably linked to how we manage the Earth's natural resources. That is why we are determined to put environmental issues where they belong: in the mainstream of American foreign policy.

... The environment has a profound impact on our national interests in two ways: First, environmental forces transcend borders and oceans to threaten directly the health, prosperity, and jobs of American citizens. Second, addressing natural resource issues is frequently critical to achieving political and economic stability, and to pursuing our strategic goals around the world.

In carrying out America's foreign policy, we will of course use our diplomacy backed by strong military forces to meet traditional and continuing threats to our security, as well as to meet new threats such as terrorism, weapons proliferation, drug trafficking, and international crime. But we must also contend with the vast new danger posed to our national interests by damage to the environment and resulting global and regional instability ... A foreign policy that failed to address such [environmental] problems would be ignoring the needs of the American people.

Finally, the U.S. Department of Energy (Haspel) will play a very important role in establishing relevant U.S. environmental policy and facing critical environmental threats, especially in the area of energy, increasingly the most valuable global resource and one of the greatest potential sources of conflict. In addition, the Department of Energy has obvious capabilities to both develop scientific understanding of, and technology responses to, the most pressing environmental issues.

## **Science and technology responses to environmental threats**

The science of natural systems and of their interactions with human systems is a very high priority, if we are to understand the consequences of our choices and actions before the choices are made, and balance our needs with those of the rest of the bio-

sphere in sustaining our quality of life. This understanding will be embodied in models of these systems and in data gathered worldwide and integrated into the models (Corell; Eisenberger; Harriss). Eventually we will have to comprehend the linkages from global conditions through ecological systems down to the explicit responses of genetic structures. In the nearer term, the accurate prediction of regional effects from global data will be of great benefit in regional distress management, emergency preparedness, optimized land use and food production, energy and emissions management, and development of cooperative conflict avoidance programs (Allenby: Definition). Anticipation of both global and local environmental impacts is critical. We cannot afford to wait until global changes have occurred and possibly unleashed irreversible processes. Such information will also be essential in the just and rational formulation of international law and treaties governing environmental actions (Lehman).

Models of regional systems are being developed currently. For example, watersheds and their coupling to freshwater surface systems and aquifers is already being modeled accurately. Such knowledge could help to avoid stress and conflict in the Middle East, in South Africa, and within India, China, and the western United States. Local atmospheric circulation models for emission management and emergency response to accidental release of hazardous gases are also now available. Both local water and air system models would be key in analyzing potential conflict situations before committing personnel and assets to a selected strategy. Eventually, the predictive and mitigatory power of these local and "mesoscale" models will be substantially enhanced by linking them to global-scale models of ocean, atmospheric, and biological systems.

Technological innovation may be the solution to some vexing environmental security problems. If clean, inexpensive point and transportable energy were available without geographic constraints; if abundant fresh water were available wherever needed; if nourishing food could be grown under what now appear to be inhospitable conditions; if more effective antifungal, antibiotic, and antiviral remedies existed; if better sensors existed and data bases were accessible for hazardous agents; if cost-efficient remediation and restoration methods for organic, metallic, and radioactive contamination were available; if global observation systems and data networks were operational, many environmental situations which are currently threatening, potentially conflictful, or already harmful might be avoided or repaired. In some cases, the economic value of technological solutions remains to be demonstrated; credible integrated assessment models and data could demonstrate this value and enable prioritization of the solutions.

Obviously, cooperation among nations and impacted regional groups, and among industry, academia, and NGO networks (Kauffman), will be important in defeating environmental threats without creating new problems. In particular, predictive models and accurate global agricultural data will afford economic advantages which will be prized and coveted. As is often the case, the first use of new technical knowledge can be as a means of achieving local advantage, which may initially hinder worldwide implementation and benefit realization. The more widely available any of the technology innovations just mentioned, the greater will be the relief from environmental stress and potential conflict, and thus, in all likelihood, the greater will be the long-term security benefit to the United States.